FIRE MANAGEMENT

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The past year has seen significant change in our attitude and approach to managing fire. The symbol of the change is a new name for our Division of Fire Control—now known as the Division of Fire Management. The substance of the change, while reflected in many of our current activities, will be developed to a larger degree by our actions in the coming years. Without lowering our capabilities as a top-notch fire suppression outfit, we must raise the quality of our performance in other aspects of professional fire management such as fuels management and fire prevention.

John R. McGuire, Chief
State of the Forest Service—1973

FIRE MANAGEMENT

An international quarterly periodical devoted to forest fire management

Fire Control Notes Becomes *Fire Management*

Fire Control Notes is gone — in name only. *Fire Management* is our new name, reflecting the change in our attitude and approach to managing fire. see **COVER**.

We are still *your* magazine, as good as your interest and contribution.

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Ranger John Chaffin talks to a group of young visitors on Roan Mountain, Pisgah N.F. (1962). He seems to have developed good rapport with them—this is essential for an effective prevention effort.

Can Teaching Fire Prevention To Children in Woods-Burning Communities Be Effective?

M. L. Doolittle and G. D. Welch

Veterans of countless fire seasons have been heard to remark that while the older generation of fire starters may be hopeless, the real hope for fire prevention is with children. The soundness of this assumption was examined in an area of high incendiarism in the Deep South. Two results will affect planning and executing fire prevention programs in schools: First, teenagers and their parents had nearly identical ideas about the usefulness of fire in forests. Second, the teens displayed stronger antiestablishment sentiment than their parents.

Incendiary fires occur frequently in the area of the present study. According to the local protection agency, most fires result either from burning to enhance woodland range for livestock or from the antics of local teenagers. Fire prevention efforts in this area are typical of those in many such areas in the rural South: signs, posters, radio, and TV spots, an occasional personal contact, and annual programs in the local schools.

The 64 children in grades 9 through 12 in the only high school in the area were asked to respond to seven statements concerning woods burning in local forests. A parent of each child (usually the father) responded to the same statements.

No Generation Gap Here

The response patterns of child and parent were similar. On the average, the children and their parents did not feel very strongly one way or the other about woods burning. However, the children displayed decidedly more unfavorable attitudes toward forest fire prevention in reacting to three statements:

1. Firing the woods is an established custom that should not be regulated by law.
2. The only reason for burning the woods is to improve grazing.
3. There is no difference between a forester burning an area and a cattleman burning.

Both parents and children strongly agreed that: "Burning the woods reduces the number of bugs, snakes, and other pests."

All of the above statements are typical of Southern woods-burning cultures that have existed for generations. Contrary to the hopes of fire prevention organizations, it appears that these customs have been passed to yet another generation in the study area. Many Southern children may be thoroughly indoctrinated by the woods-burning attitudes and actions of their parents by the time they enter school. ⟶

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In general, the planner of a fire prevention program can safely assume that the next generation will continue to present him with the same problems.

Antiestablishment Sentiment Prevails

Teenagers are often characterized as the most rebellious, antiestablishment age group of all. Twelve attitude statements concerning government agencies and big business were responded to by the teenagers and their parents in this study.

Although attitudes were generally favorable to these organizations, the children's expressed attitudes were less favorable than their parents' on the six following statements:

1. Except for 2 or 3 months of the year, the forestry commission personnel do not do enough work to justify their salaries.
2. The woods in this county should be owned by people living in this county.
3. Large companies restrict the freedom and opportunity of persons in this community.

4.-6. Persons representing (the vocational department of the school) (the forestry commission) (the Agricultural Extension Service) are sincere in attempting to assist the people in this community.

Prevention Lessons Learned

Although the study compared attitudes of children and parents, not efforts of fire prevention programs, a few general recommendations can still be made about prevention efforts with children in such a community.

1. Assume that your affiliation with a bureaucratic organization is a disadvantage. Play this association down and concentrate on person-to-person relationships.
2. Recognize that children, and particularly teenagers, are likely to have strong peer group affiliations. Try to channel fire prevention material through group leaders.
3. Do not depend entirely upon contacts in the school or school-related organizations such as FFA and 4-H for your fire prevention work. Attempt to meet with and talk to children individually and in groups at recreation centers, hangouts, and even at home. Some groups of children belittle every school-related activity.
4. Select fire prevention material tailored to the audience. Both verbal and printed materials directed to high school children should be more than a sophisticated version of the material they received as elementary students. There is evidence that Smokey Bear is often rejected by adolescents (2, 3).
5. Avoid the presentation of factual information, such as numbers of fires, acres burned, damages, and other effects; this practice is relatively ineffective in changing the way a person feels about a subject (1). Rather, attempt to relate fire prevention to students' interests.

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3. USDA Forest Service. 1968. *Public image of and attitudes toward Smokey the Bear and forest fires.* 192 p., Wash., D. C., U. S. Gov't Printing Office.

Smokey Bear Becomes Millionaire

Smokey says "It feels great, but..."

Smokey Bear has just become a millionaire. As a symbol of forest fire prevention, Smokey has had a long and illustrious career helping to make people more conscious of the waste and destruction caused by wildfires.

In the course of Smokey's 27-year career, he has been credited with saving more than 17 billion dollars of natural resources, by drastically reducing the number of man-caused fires. But in addition to all those trees, hills, and animals that haven't burned, Smokey has earned a million dollars in royalties for the use of his name.

In 1952 Congress enacted a law making it illegal to use Smokey's symbol without a license from the Forest Service. For commercial products that are sold, a small royalty fee is collected and put into a special fund to help promote the cause of forest fire prevention. This summer Smokey earned his millionth dollar from fees collected in only 10 years.

Many commercial items are made in the image of this star of TV, screen, and radio. Among them are Smokey dolls, toys, games, puzzles, and books for the youngsters. For the older fans there are tablecloths, cigarette snuffers, record albums, cufflinks, and other such items.

When asked how it feels to be a millionaire, Smokey said, "It feels great, but remember, only ***you*** can prevent forest fires."

Tool Rehandler Improved

Samuel W. Henry

Figure 1. A press on the jack will force the metal bar running up the center of the handle to push the old handle out the top.

Figure 2. Larry Bingham presses the new handle in.

Rehandling axes and pulaskis can be faster . . .

Handle alinement can be uniform and consistently correct . . .

IF you are using the Palmer Handler, designed and built by Frank Palmer of the Marana Fire Cache. This new handler:

- Presses out old handles.
- Presses in new handles.
- Presses in handle wedges.
- Maintains prescribed tool head mounting standards of alinement and depth.

Here is how you use the Palmer Handler:

Samuel W. Henry is West Zone dispatcher, Southwest Region, USDA-FS.

Figure 3. The tool, wedge, and wedge bar are in place. All that is needed is another press to drive wedge in.

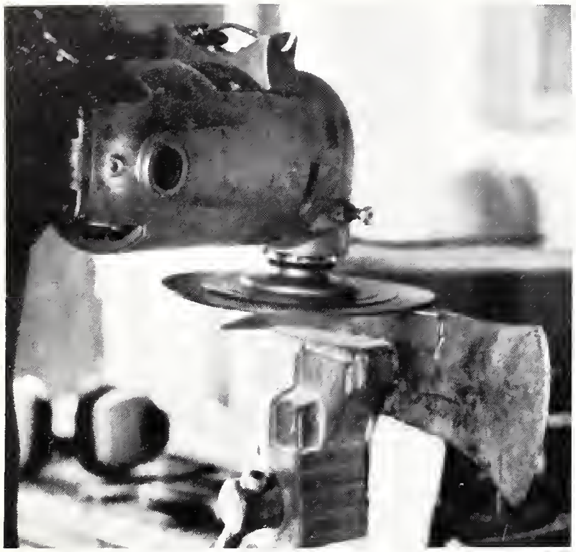

Figure 4. Protruding handle-top is being ground off.

Figure 5. Frank Palmer holds the rehandled tool; a good finishing job makes it look like new.

• With the 5-ton hydraulic jack, force the metal bar up into the head, thus displacing the old handle (fig. 1). This way you don't have to cut off the handle or remove the wedges.

• Clean tool heads as usual.

• Spread epoxy on both the eye and new handle of the tool head. With the handle started in the head, place the tool in the handler and press the parts together with the jack (fig. 2).

• Scrape off excess epoxy and apply it to a wooden wedge. Hand start the wedge into the handle, place the wedging bar on top, and finish the wedging in the handler with the jack (fig. 3).

• Cut off the protruding handle top and wedge—with a hacksaw because it eliminates splintered edges on the wedges. Grind off any remainder of protruding handle (fig. 4) and seal it with epoxy (fig. 5).

Because the handler weighs just 75 lbs., it is easy to transport, and one unit can be scheduled for use at several locations. However, since the Palmer Handler costs only about $40, all locations rehandling tools in your area could eventually build their own equipment.

If you want details, write to: Frank Palmer, West Zone Warehouseman, USFS, Marana Air Park, Marana, Ariz. 85238.

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[1] To make a supply of ground down replacement handles, use a standardized pulaski or axe head for the fit. To standardize the head, grind off the ridges in its eye. This will be the head you use as an example for all your handle grinding.

Two Relative Humidity Sensors Developed

Robert P. Matthews

Relative humidity can drop rapidly, thus presenting logging operators with extremely critical fire conditions. Instruments have been developed which will automatically monitor relative humidity and sound an alarm when a preset level has been reached, thus eliminating dependence upon the operator to remember to take and interpret readings from the conventional sling psychrometer.

Relative Humidity A Crucial Factor

Records of the severest forest fires in the Pacific Northwest parallel periods of low relative humidity. The most effective fire prevention effort for logging operation caused fires has been to halt logging during periods of critical fire danger.

In the Pacific Northwest, many forestland owners and public agencies contractually require industrial operations to stop during the fire season when RH reaches a pre-determined point, usually 30 percent. Compliance with this provision is erratic and totally dependent upon people to take and accurately interpret the needed measurements. In many areas public protection agencies supply a fire danger rating. However, general fire danger ratings are designed for relatively large geographical regions and not the local conditions, which can vary greatly from one operating area to the next. Often, by the time a public protection agency or forestland owner contacts the logging operator, it is too late to provide the protection desired.

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Psychrometer Used to Measure RH

For years the sling pyschrometer has been used to measure RH at operating sitse; however, the accuracy of this instrument as customarily used is probably ±6%. This is usually because the wet bulb is not cooled properly—also because there is a confusion and misunderstanding concerning this instrument and how to interpret its readings. These shortcomings, coupled with the obvious inconvenience it creates (to have to systematically remember to take the RH readings) point up the need for an instrument that can operate independent of human frailities.

Any forest officer or contract supervisor who has attempted to enforce the systematic RH monitoring clause of a contract knows the weaknesses of the provision. Some of the larger industrial operations evaluate humidity conditions by having supervisory personnel periodically report readings via radio. However, this practice has the same weaknesses identified above, and readings are sometimes deliberately falsified in order to prolong work periods.

Better Instruments Sought

There is the need, then, for an instrument which will automatically and accurately monitor RH and alert the operator when a pre-set level is reached. Such an instrument is being manufactured by two corporations, at the request of the Washington Forest Protection Association.

One Works on Voltage Changes

Thunder Scientific Corp. of 9720 Candelaria, N. E. Suite C. Albuquerque, N. Mex. 87112, is producing the Brady Array Model BR-101 sensor, which operates on the principle that the voltage passing through the sensor will change as the sensor is exposed to differing amounts of atmospheric water vapor. By correlating the change in voltage with changes in RH, the manufacturer states that the sensor is capable of ±2% accuracy on a scale of 5 to 100% RH. The sensing unit is about the size of a pencil eraser. Thunder's basic instrument will include the sensor and two thumb dials which can be rotated over a full range of RH readings. By rotating the dials until the alarm sounds, the operator can determine exactly what the RH is at any particular time. By setting the dials to the alarm point desired, the instrument will continually monitor the RH, and if it falls to the set point on the dials, the alarm will sound.

Thunder Scientific Corporation is currently manufacturing several of the basic instruments for field testing by Association members. The basic instrument will be designed to be located near where the crew bus is parked so it can be connected to the 12 volt horn system of the vehicle. The vehicle's horn would then sound continuously when the pre-set point had been reached. As an alternative,

The Logalert uses fibers similar to fine fuels to measure RH.

an entirely independent unit can be provided with its own battery supply and signaling device such as horn, lights, buzzer, etc.

One Works with Fibers

Another manufacturer, Interproducts, Inc., of 2377 Pollard Ct., Los Gatos, Calif. 95030, is producing an instrument which utilizes the "Xeritron" insert, cellulose crystallite fiber humidity sensor. This sensor, which reacts almost exactly like natural fine fuels, has been developed over the last 3 years by researchers trained in both forestry and meteorology. Interproducts' instrument, called the Logalert (figure), was specifically designed to meet the primary needs of the logging operator as they were expressed in the results of a recent survey.

In the Logalert, the humidity sensor operates on the same mechanical principal as the familiar home or office thermostat. When the RH reaches a given point the sensor closes a switch and the alarm sounds. The initial model has four set points at 45, 35, 30, and 25% RH. Interproducts specifies that it is accurate to ±1% RH at any set point. The unit is powered for a complete season by a commonly available transistor radio battery and is completely self-contained. It is portable enough to be worn on a supervisor's belt. Or it can be wired into the horn system of a vehicle to operate like Thunder Scientific's instrument.

Telemetery Possible

Telemetering RH readings, which is possible with both sensors, according to the manufacturers would be useful, particularly for large industrial operations that must make early morning decisions about whether or not loggers should work. It is also possible to develop a continuous recording device to replace the standard hygrothermographs used by many organizations to monitor and report relative humidity fluctuations over the fire season.

Instruments Still New

As with anything new, many questions are unanswered. However, initial production units are being put in the field and evaluated by users who will suggest modifications. Initial costs for the basic model will be about $300 per instrument. The cost will be reduced as demand increases. Although the cost appears high, it is relatively insignificant in terms of alternative investments for fire suppression equipment. It is much less expensive to prevent a fire than to suppress one! Additional information on these instruments can be obtained from the manufacturers mentioned or from the author.

Alarms As Good As Men Who Use Them

Refining the technology of automatie humidity alarms depends on the commitment of those concerned with fire prevention needs in logging operations. Loggers must be able to understand the relationship between low RH, sparks, and susceptible fuel in order to know when it is unsafe to log.

Figure 1. Richard Ramberg loading grenades into dispenser. This and another dispenser will then be clamped to the mounting bracket on the helicopter.

Incendiary Grenade Dispenser Evaluated In Alaska

Richard Ramberg

Alaska was the evaluation site of a system to safely dispense incendiaries from helicopters. Except for a few minor problems, the Equipment Development Center at Missoula reports use of this dispensing system satisfactory. More testing of the system, found and developed by Missoula EDC, will follow.

Predetermined performance requirements were:

1. The pilot must be able to eject the dispenser in case of an inflight emergency.
2. The equipment should be operable by the pilot if a firing specialist is not aboard.
3. The dispenser system should hold at least 12 grenades and drop them at a rate of at least one per second.
4. The system should be adaptable to the makes and models of helicopters commonly available.
5. The system should be simple to maintain and operate.

Richard Ramberg is project leader, Missoula Equipment Development Center, Missoula, Mont.

Smoke Grenade Dispenser Used

After examining dispensers available from commercial and military sources, the military model XM118 manufactured by Fairchild-Hiller was selected. This dispenser is designed to drop smoke grenades but will accommodate any grenade in the 2½ by 4½ inch "beer can" type container. Each dispenser will hold 12 grenades (fig. 1). One dispenser was mounted on each side of the helicopter (fig. 2).

Since the controls for the system are built into the military helicopter, a control unit and mounting bracket were fabricated for use with Government-owned or contract helicopters. The control unit has four firing buttons, each controlling a row of six grenades. When the last grenade in each row is dropped, a light glows on the control box.

Mounting brackets utilizing a Handley Bomb Rack were assembled for attaching the dispenser to commercial helicopters. This rack allows the pilot to drop the dispensers in case of an inflight emergency or malfunction.

Evaluated in Alaska

Early in August 1972, the equipment Development Center received a request for aerial firing systems from the Bureau of Land Management in Alaska. Near Allakaket were several large fires BLM wanted to burn out to natural barriers. Coordination was done through the Boise Interagency Fire Center to evaluate the launcher on the Alaskian fires. The author flew to Alaska with the dispensers to serve as technical advisor to the BLM.

The BLM evaluation team was headed by Bill Adams from the State office in Anchorage. Jerry Costello, also from the State office, acted as data collector, and Don Doyen from BIFC was the safety officer. Bob Johnson, Fairbanks District chief pilot, flew the BLM-owned FH 1100 during the drops. A local contractor was hired to record portions of the evaluation on video tape.

The dispensers were mounted on a

See Grenades, p. 13

The Most Important Question:

How Could *This* Fire Have Been Prevented?

John S. Crosby

What do highway caution signs and Smokey Bear posters have in common?

That's right! Both are prevention tools. The caution sign is used to help prevent auto accidents, and the Smokey poster to help prevent forest fires. Highway safety and fire prevention programs have many other similarities. Both deal with people; both are aimed at the prevention of losses and injury; both programs must maintain public interest; and, unfortunately, neither program is likely to achieve total success.

A work safety program is designed to help prevent accidents too. Stress is placed upon on-the-scene analysis to answer the question, "How could this accident have been prevented?" Accident prevention learned from the answers provides much of the material used in safety handbooks. However, on-the-scene fire reporting seldom raises the question, "How could this fire have been prevented?" And that's too bad. Well-known and useful specific fire prevention devices and schemes have resulted when someone seriously raised this question and then found and implemented answers.

Basic fire reporting forms usually ask, "Who started this fire?" "How did it begin?" "Where did it start?" There is a real need to get the best possible answers to these questions. But unless the investigation leads to a strategy that *prevents* a similar fire in the future, the investigation is largely wasted.

Often there is a time gap between fire investigations and prevention planning. This results in prevention plans that are based on statistical summaries of fires by causes and classes of people responsible. By the time that is done the *individual* responsible for a specific fire along with his reasons for burning or the real causes of the fire have disappeared into a forest of averages. As a result, stale and perhaps inappropriate remedies are likely to be offered as solutions.

John S. Crosby is principal fire research scientist, North Central Forest Experiment Station, USDA Forest Service, East Lansing, Mich.

Plan Prevention Fire By Fire

The direct approach would require the investigator to recommend specific prevention action on the fire report form. Prevention planners could, then or later, sift these recommendations, reviewing specific proposals made under real situations. From these a hard-hitting specific program of preventative action could evolve.

Most eastern and about half the western fires are man-caused. So, much of the fire prevention strategy must be aimed at people. The intent of man-caused fires ranges from intentional and malicious actions to unintentional and accidental fire starts. Through the middle of this range are the escape fires—those resulting from intentional, legal, and traditional uses of controlled fire.

Varied specific prevention activities are needed to combat the wide range of fire causes.

Fires are classified into a small number of general causes although there are numerous specific causes of fires. Likewise, there are only a few general methods of fire prevention (education, regulation, enforcement, etc.), but there are numerous specific ways to apply any one of the general methods. So, how do you select the action most likely to succeed?

Always Ask Three Questions

Think of it this way: The answers to three key questions will fairly well characterize the cause of fire within

the range of intent and will indicate the appropriate general method of prevention needed. Investigation must first find answers to the questions. Ingenuity must then supply the specific prevention action. The questions and appropriate prevention are these:

1. *Was the responsible person aware of the risk of starting a wildfire?*

If the answer is NO, we need to improve awareness of risk among the groups of people who inadvertently start fires. Education and training in fire behavior and fire effects are needed so that people can recognize risks and be aware of the consequences of wildfires.

2. *Did the person responsible legally use fire or a fire brand?*

There are many illegitimate uses of fires and fire brands, from lighting tobacco with a lighter to starting a prescribed fire with a drip torch. If there is no intention to start a wildfire while using fire brands or fire, the reason for the fire must be carelessness, lack of skill, ignorance of fire behavior, or some malfunction of equipment. If the answer is YES, several possible remedies are suggested:

1. Develop or require responsibility among fire users:
   a. Provide education and training.
   b. Regulate fire use by law and regulation.
   c. Enforce laws and regulation and punishing offenders.
   d. Collect suppression costs and damages.
   e. Make regular inspections of equipment and jobs involving risk of fire within the legal framework, recommending improvements in practices, and requiring compliance with standards of safety.
2. Issue warnings:
   a. Release up-to-date fire weather and fire danger warnings at strategic locations and by appropriate media.
   b. Make use of forest closures when warranted.
3. Emphasize engineering:
   a. Develop safer tools and brands through research and development.
   b. Find alternative, safe ways of doing jobs that have been done with fire brands or fires.
   c. Modify and reduce hazardous fuels.

3. *Did he intend to start a wildfire?*

If this question is answered YES, the problem is one of unfavorable personal attitudes toward the community, public or private organizations, other individuals, land use, community problems, safety, or values. Changing attitudes is difficult, but three general approaches are used:

a. Appeal to reason—show, demonstrate, educate, involve.
b. Solve problems of conflict.
c. Take corrective actions and publicize results.

Answers Suggest Solutions

Different combinations of the three answers will also tell much about the prevention problem and how to attack it. A YES to the first and third questions and a NO to the second, pinpoints the incendiary. Here the problem most likely is one of attitudes or compulsions. Among the typical reasons for incendiary fires are; pyromania, settling grudges, creating jobs, improving game habitat, and improving berry production.

If the second question is answered YES and the third NO, the middle range problems are indicated. These fires usually start because of carelessness, ignorance, or lack of skill or training. More responsibility and knowledge among fire users must be induced. Typical causes in this group are debris burning, community dump fire escapes, escape campfires, smoker fires, children playing with matches, or even escaped prescribed fires.

If all questions are answered NO the fire must be classed as unintentional and accidental. The responsible person may not even be aware he is a potential fire starter. Therefore, prevention solutions must include safety in machines and their operations, require safety inspections and legislation to support inspections, and prescribe penalties for noncompliance. Typical fire causes in this group are explosions; auto, railroad, or aircraft crashes; faulty equipment; exhaust sparks; and spontaneous combustion.

Tailor Solutions to Situations

Although education, enforcement, engineering, and warnings are all old, well-worn methods of prevention, there are unlimited specific, ingenious ways to apply them.

How to apply the method is as important as selecting the action. It is here the local fire investigator can be more helpful. He can recommend a specific action that will fit the individual situation. He probably knows that John Jones knew better but was just careless with his debris fire. But Mrs. Smith just didn't know her rubbish fire could start a wildfire. If either mistake is costly, lessons may be learned, but there are others like Mrs. Smith, who need to know more about fire, and there are more who know better but just don't make the effort. So, prevention planning involves—*how to reach these others with the appropriate method before they too make a mistake.* The investigator likely knows his people and how they respond, so he should be best qualified to recommend how to keep them from repeating the old mistakes. His method may be as planned and subtle as the smoke signal he received. Planned or unpanned, much effective prevention is accomplished this way.

The fact remains that an effective prevention program begins with the question: *How could* this *fire have been prevented?* It is the reason for conducting an investigation. Prevention action suggested by fresh situations should carry weight in planning successful prevention programs. Why not ask this question on every individual fire report?

Grenades, from p. 9.

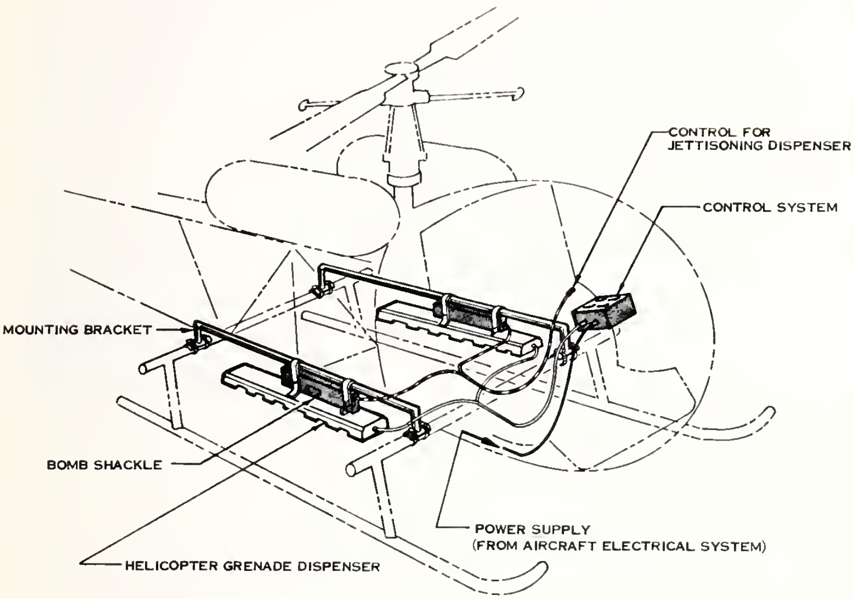

Figure 2. Diagram of dispenser placement.

FH 1100 helicopter at Fairbanks, and several cases of M-14 Thermate grenades were obtained from the Army at Fort Richardson. Since there was not enough room to work beneath the helicopter, the dispensers were removed from the bomb racks for loading. Time checks indicated that two experienced crewmembers can safely load the dispensers in less than 5 minutes.

Two Kinds of Grenades Tested

When dropped at a low altitude, the Thermate grenade burns very hot in a small area. By dropping the grenade high enough to ignite above the trees, the trailing molten slag produced a strip of ignition on the ground about 40 to 50 feet long (fig. 3).[1] The grenades were dropped along manmade and natural barriers including handlines, retardant lines, live streams, and green, wet areas.

A load of the American Service Products incendiary grenades was also dropped. These grenades have a burster type of fuse that spreads burning particles over a 300 to 400 foot circle. The grenades work well for area ignition in fine fuels, but because of the wide dispersion of particles, they could not be used close to the control line.

Use Successful

A total of 780 grenades were dropped on three large fires and an estimated 20 miles of line burned out. The unit worked satisfactorily in Alaska except for a few minor electro-mechanical problems. These are being corrected, along with the preparation of drawings, use instructions and procurement arrangements.

Plans are being made for additional evaluations in other fuel types.

[1] Before the drop it was determined that no firefighters or others were in the vicinity where grenades were to be dropped because of danger of injury from falling canister or burning slag. This is an essential precaution when using incendiary grenades.

Figure 3. Trailing molten slag, this grenade will ignite a strip of ground 40-50 feet long.

Computer Time-Sharing Used with NFDRS

R. William Furman and Robert S. Helfman

For the National Fire-Danger Rating System and other fire management tasks, a computer communications system is needed that can collect meteorological information, compute fire danger ratings, and display both types of information upon request. Such a system, using time-sharing computers with remote input-output accesses, was tested in Region 3 starting March or April 1973.

In this article, we want to:

1. Introduce the concept of computer time-sharing into operational fire management.
2. Review the development of an operational time-sharing program for the National Fire-Danger Rating System (NFDRS).
3. Show the potential for using the computer time-sharing version of the NFDRS in daily planning.

Problem Is Complexity

Manually collecting, analyzing, and distributing all of the information necessary to use the NFDRS often results in errors. These errors can occur in the table look-up process and in transmission.

These problems exist because of the many tasks required to get operational fire danger information. Observed meteorological information has to be converted into rating numbers. Observed meteorological information must be passed to the National Weather Service forecaster to be assimilated into a 24-hour forecast. Forecasts must be distributed to the fire management users to be converted into fire-danger rating numbers. Finally, the fire-danger rating numbers have to be combined to produce meaningful information on which to base management decisions.

Inadequacy Is A Problem

The communication systems available to most Regions consist primarily of radio, telephone, and teletype. The systems as they are currently used are not set up to make transmitting large amounts of data easy. Collection of meteorological data at a central site and the retransmission of the data back to the users in the form of 24-hour forecasts is slowed because the information goes to all the users through a single device, usually the teletype or in some instances a radio network. Users are further inconvenienced by having to filter all the data in order to pick

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out only what they need. Because of the work involved and time schedules which must be adhered to, users are often unable to utilize all the information available to them.

The answer may be a time-sharing computer system. Computers can handle a multitude of data as well as extract only what a local area needs.

Computer Time-Sharing Helps

It is not necessary these days to own a computer to be able to use one. You can subscribe to a computer time-sharing service and have most of the advanatages of ownership and few of the problems. Subscribers communicate with this computer from remote locations, usually by a telephone-teletype system. These computers operate on a time-sharing basis, which simply means that many programs can be handled by the computer simultaneously. Users may store programs and data in the computer for future use or make use of an extensive library of programs that is always available on the computer.

A program stored in the computer can be activated by indicating its identifier to the computer and by typing simple answers to a few questions from the computer. The user need not know intricacies of either the computer program or the time-sharing system. Many users may simultaneously use the same program or data from different remote locations.

Other uses of time-sharing computers that have potential in fire management include equipment and personnel inventory, maintenance scheduling, resource inventory and management, and individual fire reports.

NFDRS Project Uses Time-Sharing

The National Fire-Danger Rating Project in Fort Collins has taken advantage of time-sharing by developing an information communication system around the National Fire-Danger Rating System. With this communication system, meteorological data can be entered into the computer, and *current* fire-danger rating indexes will be calculated. The meteorological data are then available to the forecaster. He can enter the weather predictions and the *forecasted* fire-danger rating indexes will be determined. Original data can also be checked and stored permanently, alleviating the need for further handling. All the information is stored in a common data storage file and is availabe to all users of the system.

The fire-danger rating information system is basically four elements; catalog, current observation file, interpreter, and processor.

The *catalog* is that part of the system which stores semipermanent information about each station such as elevation, slope, fuel models, etc. Once that information is entered, it then becomes part of the record and is used in subsequent processing. Information in the catalog may be changed at any time.

The *current observation file* (c.o.f.) is that section of the system in which the meteorological observations and forecasts and the corresponding computed indexes, components, and manning level(s) for each station are stored. The contents of the c.o.f. are available to all users at any time.

The *interpreter* is the section of the system that converts the users' conversational instructions into computer language for the processor. It also performs a myriad of checking operations on the input data.

The remaining portion of the system, the *processor*, controls all operations from initial catalog entries to processing of meteorological observations and forecasts to maintaining the c.o.f. and storing old data on punch cards or magnetic tape. It retrieves for display the desired amount of information only. The processor is controlled from the terminal keyboard by a set of simple conversational commands. It also has a comprehensive error message library built in to protect the user from common operational mistakes.

Data Handling Minimized

An undesirable feature of the present method of transmitting information is that users must cull a lot of data they do not need. This has been virtually eliminated by a feature of the processor that allows the user to select the fire-weather stations for which he wishes information. He may further select the type of information he desires, meteorological, fire danger, or both; observed, forecasted, or both. Information can also be retrieved according to administrative or governmental areas, such as forest, region, county, State, etc. Such flexibility makes the grouping and digesting of information much quicker and more meaningful.

NFDRS Uses New Program

The NFDRS computer program "Automatic Forest Fire Information Retrieval and Management System" (AFFIRMS) was designed to be part of the daily fire planning operation. It can be used as a communications system to disseminate both raw and forecasted weather data and analyzed fire-danger information to all users for the planning of daily fire management operations. We visualize that in the future, AFFIRMS could be included in the daily fire planning operations as follows:

1. The forest dispatcher will enter midafternoon fire-weather data into the system. The dispatcher will then call for and receive the current fire-danger indexes and manning classes for the stations in which he is interested.
2. The fire-weather forecaster will retrieve the fire-danger observations of the stations in his forecast area.

COMMAND?DSPW □BS,SIG,001;

09/25/72 — 15:44MDT

STA-N□	DY	HR	S	DBT	RH	HRB	LR	MCR	DIR	WS	V	10H	TMX	MN	HMX	MN	PD	PPAMT
20209	25	13	1	64	29	10	0	10	SW	13	0	14	0	0	0	0	0	0.
20203	25	13	0	64	30	10	0	10	SW	2	0	6	0	0	0	0	0	0.
20503	22	13	1	87	15	30	0	10	SE	14	0	0	0	0	0	0	0	0.
20205	25	13	1	67	23	20	0	10	SW	4	0	6	0	0	0	0	0	0.
20202	25	13	1	63	56	20	0	10	W	10	0	8	0	0	0	0	0	0.

COMMAND?DSPI □BS,SIG,001;

09/25/72 — 15:45MDT

STA-N□	M	S	DY	HR	RH	WS	RSK	FFM	10H	100	IC	SC	ERC	□I	BI	FLI	MC
20209	C	1	25	13	29	13	10	5	14	0	56	10	17	6	12	1	3
20203	C	1	25	13	30	2	10	5	6	0	56	0	23	6	4	0	2
20503	A	2	22	13	15	14	10	7	0	0	46	17	11	5	4	0	2
20205	C	1	25	13	23	4	10	6	6	0	49	1	22	5	6	0	2
20202	C	1	25	13	56	10	10	12	8	0	17	4	14	2	8	0	3

An example of the output from AFFIRMS for a series of weather observations. This is the type of output that is available after the weather information has been processed. The upper set of numbers is the weather data display. Column headings are (l. to r.) station number, day, hour, state of weather, temperature, humidity, herbaceous vegetation condition, lightning risk, man-caused risk, wind direction, wind speed, woody vegetation condition, 10-hour fuel moisture (½-inch stick moisture), maximum temperature, minimum temperature, maximum humidity, minimum humidity, precipitation duration and precipitation amount. The lower portion is a display of the fire danger information. Column headings are (l. to r.) station number, fuel model, slope, day, hour, humidity, windspeed, total risk, fine fuel moisture, 10-hour timelag fuel moisture, 100-hour timelag fuel moisture, ignition component, rate of spread component, energy release component, Occurrence Index, Burning Index, Fire-Load Index, manning class.

This information will then be integrated into his fire-weather forecast.

3. Then the fire-weather forecasts will be entered into the system for each forecast zone or station or some combination of both. This includes the narrative portion of the forecasts, which then becomes available on demand to all users.
4. The components, indexes, and manning classes for the forecasted weather for his stations of interest will then be called for by each dispatcher, using a simple set of conversational instructions.

Observations that have been superseded by more current information will be saved on a mass storage file for later transfer to cards or magnetic tape, which will be mailed to the users for permanent storage.

In addition to the regular mode of usage outlined above, the stored information will be available to others. For example:

1. Zone and regional dispatchers will have ready access to the fire weather and fire-danger indexes in a presorted, preselected form. It will be easy for them to keep informed on the weather and fire danger in any sub-area of their area of responsibility.
2. Agencies with crews in other areas will be able to keep advised on changes in fire danger anywhere.
3. National coordinating centers, such as the Boise Interagency Fire Center, will be able to monitor fire danger anywhere in the nation.
4. State and private forestry offices will also be able to take advantage of the system and become part of a nationwide data bank.

Future Is Promising

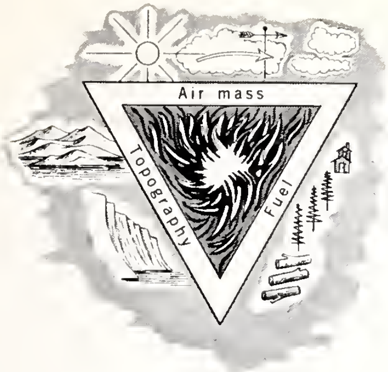
There are several advantages to this system over the present operation. Data are available to every user on request in neat, tabular form (figure). Since the user can select only those stations for which he wants information, he need not wade through a lot of unnecessary data.

Accuracy is a big advantage. You can be sure that the indexes and manning classes provided by the computer are as accurate as the input data. When put in, the data are checked for continuity, which will detect a large percentage of keyboard errors. Furthermore, when old data are superseded by more current information, collected, sorted, and stored on cards or magnetic tape for distribution to the users, the number of times weather data must be handled is minimized.

The Coconino and Apache NFs used part of the system on a trial basis during July, August, and September 1972. Feedback showed that use of this program was a simple clerical task and did not require extensive training.

Every effort has been made to keep the cost of such a service within reach of most fire management agencies, but a firm estimate of the cost of operation will not be available until after a trial period.

Presently, plans are being made for a full-scale field trial with the National Forests and the National Weather Service in Region 3. The field trial began in March or April 1973 and will extend through the fire season to late October or November. Final program changes or adjustments will be made during this trial. By January 1974, AFFIRMS should be available for general use.



The Fire Environment Concept

A New Pacific Southwest Forest and Range Experiment Station Publication

by Clive M. Countryman

The following is an excerpt:

Prediction of fire behavior for safe and effective control and use of fire requires understanding of the interactions of fire with its environment.

Fire environment is the surrounding conditions, influences, and modifying forces that determine the behavior of a fire.

The fire environment consists of three major components — topography, fuel, and air mass. From a fire standpoint, topography does not vary significantly with time but does very greatly in horizontal space. The fuel component varies in space and also in time; however, fuel characteristics, except for the moisture content of dead fuel, change slowly enough to be considered static for any one fire. The air mass is usually the most variable component, changing rapidly in both space and time.

Fire behavior is the interactions of the environmental components with each other and with the fire. The current state of each of these influences and their interactions determine the behavior of a fire at any moment.

Fire behavior is the result of complex interrelationships of aerodynamics, chemistry, thermodynamics, and combustion physics. Nevertheless, it is possible for firefighters to acquire sufficient skill in predicting fire behavior to allow safe and efficient control and use of fire. Development of this skill must come from experience and from training in the fundamentals of fire behavior and fire environment.

This publication and "This Humidity Business," also by Clive Countryman, are available from Forest Service, U. S. Dept. of Agriculture, P. O. Box 245, Berkeley, Calif. 94701.

You're in Your Car and Surrounded by Flames:

DON'T PANIC!

N. P. Cheney

N. P. Cheney is with the Forestry and Timber Bureau, Dept. of Natural Development, Canberra, Australia

A number of popular misconceptions, such as death from lack of oxygen if you are trapped in a fire or that a car gas tank will explode if exposed to naked flame, cause many persons to panic and sometimes flee a safe refuge. This does not have to be.

Over several years, studies in and around Canberra by officers of the Forestry and Timber Bureau have produced information to aid human survival in bushfires. This article is based on their findings.

Cars Shield

To study the performance of a car as a shield against radiation, cars were subjected to intense radiant heat from windrows of burning pine slash.

The car windows cut down the radiation inside to around half of that received outside at the peak of the fire but a person inside would have suffered severe burns to any bare skin.

Although air temperature inside the car did not rise to a hazardous level, smoke from smoldering plastic and rubber materials used in interior linings caused severe discomfort. However, as already mentioned, the period of intense heat in the tests exceeded that which would be experienced in most forest situations and was far greater than would ever be experienced in grassfires.

Furthermore research has shown that the standard gas tank is quite difficult to explode. When a tank contains gas the space above the liquid contains a mixture that is too rich in gas vapor for an explosion to occur.

Radiant Heat Kills

In grass or forest fires, the main cause of death is heat stroke in an extreme form as a result of excessive heat radiation. Even severe burns to the body are not an immediate cause of death unless accompanied by heat stroke.

Most of the heat felt from a bushfire is radiant heat, and though it can reach high intensity it lasts only a relatively short time.

Radiant heat, like light, travels in straight lines, does not penetrate solid substances, and is easily reflected, physical principles basic to survival procedures.

Even in severe fires the temperature near the ground remains cool as hot combustion gases are rapidly carried away by convection. Measurements have shown that air temperatures within a few feet of the ground and within a few feet of flames up to 35 ft. high are less than 120 degrees Fahrenheit. While air at this temperature may be unpleasant it can be breathed. Bushfires in the open do not deplete the oxygen concentration in the air outside the actual zone where combustion is taking place.

Be Careful

In spite of warnings and precautions, situations will probably continue to develop in which fires threaten houses and trap car travellers. The Forestry and Timber Bureau offers the following advice:

- Do not drive a motor vehicle blindly through heavy smoke. Switch on headlights and park adjacent to bare areas beside the road as far away as possible from the leading edge of the fire. Or park where roadside grass is shortest.
- Wind up all windows and shelter yourself from radiation beneath the dashboard with a rug or some other article (such as a floor mat) covering your body. Remain calm and have confi-

This is the end cutaway view of a FS forest fire shelter that works on the same principle explained in the article. See Equip-Tip *Improved Forest Fire Shelter*, June 1968.

dence that the gas tank will not explode, and that even in the worst situations it will be some minutes before the vehicle catches fire. If the vehicle does catch on fire you can leave it but keep your skin covered as much as possible.

- Remain calm and do not run blindly from the fire. If you become exhausted you are much more prone to heat stroke and you can easily overlook a safe refuge. Consider an alternative course of action.

Behind all these instructions are three basic principles which must be remembered at all times:

- Select an area where there is the least amount of combustible material.
- Use every means to protect yourself from radiation from the flames.
- Remain calm and don't panic.

Related Reading

Clive M. Countryman. 1971. *Carbon monoxide—a firefighting hazard.* Pacific Southwest Forest and Range Experiment Station, USDA, Forest Service, P. O. Box 245, Berkeley, CA. 94701

U.S. Dept. of Health, Education, and Welfare. *Criteria for a recommended standard: "Occupational Exposure to Carbon Monoxide"*. Washington, D. C.

New NFPA Guidebook Helps Volunteer Firefighting Groups

Recommendations for Wildfire Control and Environmental Improvement (NFPA No. 295), includes basic information for volunteer groups in small towns and in suburban and rural areas on how to organize a fire department, select equipment, and train personnel to fight small outdoor fires.

Formerly titled *Forest, Grass and Brush Fire Control*, this 68-page text is a guide for small communities in rural, forest and wildland areas and has just been published by the National Fire Protection Association (NFPA).

New material includes recommendations for spark arrestors on power saws, for selective use of herbicides to control vegetative growth, and for application of chemicals for fire suppression. There is detailed information on operation of pumper trucks directly on the fireline.

Careful evaluation of outdoor fire in the United States and Canada for many years has shown that tremendous damage can be prevented if such fires are attacked by trained crews in the early stages of fire development. If not controlled, these fires can endanger human life, cause serious property damage, result in air and water pollution, and destroy irreplaceable natural resources.

The original NFPA No. 295 was developed by the NFPA Forest Committee: the present version was adopted at the 1972 NFPA Annual Meeting.

Copies of the 1972 edition of *Recommendations for Wildfire Control and Environmental Improvement* (NFPA No. 295), 68-pages, $1.75, are available from the NFPA Publications Service Department, 60 Batterymarch St., Boston, Mass. 02110.

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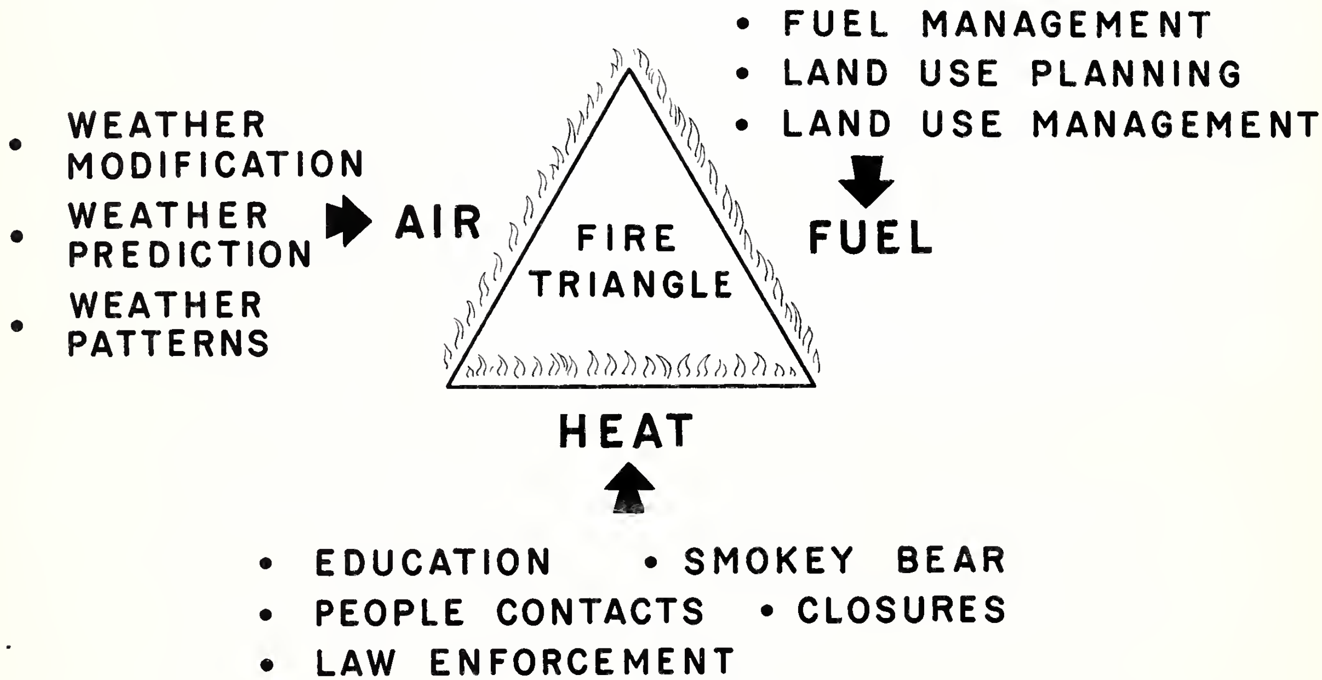
A new dimension in FIRE PREVENTION



An exciting new dimension is developing in fire prevention: action programs taking aim at the FUEL side of the fire triangle.

Up to now focus has been on the HEAT side of the triangle. As the diagram shows, the traditional prevention program has consisted mainly of efforts to alter people's behavior.

AIR, or weather, being the least known side of the triangle, has received emphasis from research.

The new opportunity lies in attacking the third side of the triangle—FUEL. Fuel management, usually considered mostly as an aid to suppression, is actually fire prevention of the highest order. Lowering the flammability of the forest through fuel management is becoming the great new dimension of fire prevention.